Hawking Radiation as Tunneling through Black Holes

A black hole is a region in space where the pull of gravity is so strong that even light cannot escape. According to classical theory of black holes, once something crosses the event horizon, it can never come back out. In Schwarzschild metric, r= 2M is the radius of the event horizon and M is the mass. Anything that is in the region r > 2M can escape to infinity, once it crosses r = 2M into the region r<2M, gravity is too strong and it will not be able to escape. A black hole is called such because it is like a black body that absorbs everything, but does not reflect anything. The quantum theory of black hole, however, states that black holes do in fact emit thermal radiation. This radiation is called Hawking radiation named after its discoverer, Stephen Hawking. It has been stated that Hawking radiation can be viewed as a tunneling process. In classical mechanics, it is not possible for a particle to break through a barrier with potential V if the energy E of the particle is E<V. In quantum mechanics, particles have a finite probability of breaking through the barrier even if E < V, this phenomenon is known as tunneling. Since Hawking radiation is emitted from a black hole, one can think of this as a tunneling process as it breaks through the barrier, the event horizon. This research focuses on understanding the tunneling process in black holes due to Hawking radiation.

1) *Hartle, James B. Gravity. San Francisco: Addison Wesley, 2003. Print.*
2) *Hawking, Stephen W, and Roger Penrose. The Nature of Space and Time. Princeton: Princeton University, 1996. Print.*